ABSTRACT OF THE DISCLOSURE

A neutron generator includes a modular arrangement of a high current electron bombardment ion source , providing deuterium(D) and/or tritium(T) ions, a high voltage acceleration stage to accelerate the ions and raise the ion energy to the order of 100 keV, and an occluded reaction target containing T and/or D to produce the nuclear reactions. Neutrons are produced in the target using the D-D and/or D-T reaction. The invention is designed to allow the target to be located at the end of a needle and thereby is useful for treating cancers by the Brachy therapy method. The ion source of the neutron generator is a modified version of the electron bombardment type used in mass spectrometers for gas analysis. This source uses an electron beam running through an ionization chamber to ionize gas molecules that are extracted out of the chamber by electric fields. The ion source has been redesigned for higher current by providing a larger electron beam and enlarging the extraction slit and subsequent focusing element apertures to 3 mm or more. This modified source provides microamperes of ion current at operating pressures in the 10^{-4} torr range, whereas a typical mass spectrometer source for radio frequency instruments (0.1 mm extraction orifice), produces many decades lower output. An embodiment particularly suited for treating tumors as well as methods for using it are disclosed.